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UNITED STATES DEPARTMENT OF AGRICULTURE

BUREAU OF ENTOMOLOGY

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REPORT

ON

A STUDY OF THE LOSSES

ON

THE MORRISON CUTOVER AREA.

By
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Room 423,
Jordan Hall,
Stanford University, Calif.

November 2, 1927.

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A STUDY OF THE LOSSES ON THE MORRISON CUTOVER AREA.

INTRODUCTION

The Morrison cutover area on the Shasta National Forest, Sec. 28, T 43 N., R 3 W., was examined in August, 1925, in connection with the study of insect losses on cutover areas. A statement of the conditions found was included in "A Report on Studies of Insect Losses on Cutover Areas of District 5", by the writer, dated Feb., 20, 1926. The area showed a very heavy loss from insects, amounting to about four times the increment, and upon the suggestion of Show and Woodbury it was decided to make a more complete study of the area to determine the total loss since the area was logged and causes for this loss.

Description of Area.

The area includes a full section of pure yellow pine type on a site V. It is fairly typical of large areas of the poorer sites on the east side in northern California and Southern Oregon. The soil is a volcanic ash with outcropping lava ridges. The elevation is about 5800 feet and the topography is quite level.

The ground cover is about 90% brush with some scattered patches of yellow pine reproduction. The area is bounded by a clean cut area on the south, a scattered stand of yellow pine on the north, and east and a brush flat on the west.

History of the Area.

The area was logged as a trespass area by the Weed Lumber Company in 1905. 6,500 M.B.M. was taken from the area. The Weed Company did their own marking and evidently took out only the best of the timber over 16 inches without making any effort to open up and improve the stand. The 1927 examination showed that a large number of deformed and decadent trees had been left and many of the younger trees left were in such close groups that comparatively few vigorous trees were to be found on the area.

The section was logged with wheels and horses. No slash disposal was practised, the tops and limbs being left unlopped.

The area was cruised in May, 1925, by the Forest Service and at that time there was a stand of 710,400 bd. ft. of yellow pine on the section.

THE 1927 EXAMINATION.

The 1927 examination was made between June 18 and 24th by the writer assisted by De Leon, a field assistant. The field expenses incident to the examination were borne by the Forest Service. Salaries were paid by the Bureau of Entomology.

Methods.

A 100 percent cruise was made by the strip method. Strips 5 chains in width were used. Every dead tree on the area, both standing and fallen was marked and examined. The diameter, number of logs, cause of death and approximate time when killed was recorded for every tree on the area, killed after 1905. Diameters were taken with a biltmore checked with occasional measurements with a diameter tape.

By supplementing the 1927 data with the figures from the 1925 cruise it was possible to get fairly accurate annual loss figures for the period 1923 to 1927. It was estimated that only about 40% of the total loss for 1927 had occurred at the time of the examination so the 1927 loss was estimated on that basis. The date when killed for trees killed before 1923 is necessarily only approximate, being based on the condition of the wood and the number of twigs and small branches retained. It was not difficult to determine whether or not old fallen trees were killed after the area was logged as they could be compared with the tops cut at the time the area was logged.

Results.

The total loss on the section for the 22 years since the area was logged is 1831 trees with a volume of 487,100 bd. ft.

The loss occurred approximately as follows:-

TABLE I.
Total Loss 1906 to 1927 Inclusive.

Year	No. Trees	Volume in Bd. Ft.
1927	108	32,600
1926	118	29,270
1925	94	21,220
1924	83	19,560
1923	46	12,790
1922 - '27	449	115,440
1917 - '22	476	117,010
1912 - '17	666*	178,800
1906 - '12	240	75,850
Totals	1831 trees	487,100 bd. ft.

Note: *The very heavy loss that occurred between 1912 and 1917 may be largely accounted for by a fire which killed or weakened a large number of trees, during this period.

The effect of this fire probably extended over into the next 5 year period. The consistent increase from 1923 to 1927 is probably the result of a low precipitation period which began in 1917 and has continued up to the present time.

Of the total number of dead trees 1,100 with a volume of 304,570 bd. ft. had fallen and 731 with a volume of 182,590 were still standing.

Relation of Loss to the Volume Left after Logging.

When the area was cruised in May, 1925, by the Forest Service the volume of the yellow pine (living) on the area was 710,400 bd. ft. The loss from 1905 to 1925 was 391,440 bd. ft. The sum of these two figures gives a volume of 1,101,840 bd. ft. left after logging in 1905. Since the total loss, 1905 to 1927 is 487,100 bd. ft., 44.2% of the volume of the stand left after logging has been killed in the last 22 years.

Primary Causes of the Death of the Trees.

Insects, fire and wind have been responsible for the death of the trees. The western pine bark beetle (D. brevicomis) is the principle offender though a number of trees were apparently killed by buprestids (either Melanophila gentilis or M. californica) and also by the mountain pine beetle, (D. monticolae). The following table shows the importance of the different causal agents:-

TABLE 2.

	No. of Trees	% of Total	Vol.
Killed by D. brevicomis	1270	69.4	347,230
" " Melanophila spp.	176	9.6	
" " D. monticolae	57	3.1	
" " Fire	212	11.6	
" " Wind	116	6.3	
Total - - -	1831		

D. brevicomis is accountable for by far the largest part of the loss, practically 70 per cent. Fire is probably more important than the table shows, as many of the trees killed by insects had some fire injury which probably weakened them and made them more susceptible to insect attack.

The above figures are only approximate as many of the trees showed the work of more than one insect or the work of insects together with fire injury so that the primary cause of death could not always be determined.

The Relation of Growth Rate to Insect Loss.

To determine the growing conditions on the area for the last 25 years, increment cores were taken from 25 average trees and the ring widths measured. By averaging the 25 cores the comparative growth rate for average trees was found for the years 1903, 2 years before the area was logged, to 1926. The 1927 ring was not complete. The results are shown graphically on plate1. A number of interesting points are brought out by a study of this graph.

1. The logging of the area evidently caused very little acceleration of growth in the trees that were left. The effect of the cutting would not be noticeable at all on the growth rings until 1906 and not very much before 1907, so that the only increase that should be credited to release would be between 1906 and 1907. The sharp decline from 1907 to 1910 more than offsets this increase.

2. There is probably a definite relation between the growth rate and the amount of loss by 5 year periods though this is partly concealed by the fire which caused the very heavy loss between 1912 and 1917. The smallest loss occurred between 1906 and 1912 during a period a fairly good average growth and much of this loss was probably due to the death of decadent trees which, under present Forest Service practise, would be taken out, when first logged. As noted the period 1912 to 1917 was disturbed by fire and so cannot be considered in this connection. The heavy, sustained loss from 1917 to the present time is closely related to the very slow growth for the same period which is probably the result of submormal precipitation. See Plate I.

It was found in the tree selection studies reported on April 5, 1926, by the writer, that over 90 percent of the trees killed by the western pine beetle (on the areas studied) had an average annual ring width of less than 1 millimeter. As shown on Plate I the average ring width of the trees measured has been less than 1 millimeter since 1917. It is interesting to note that a marked increase in the D. brevicomis infestation over much of the east side pure yellow pine type of northern California and southern Oregon started in 1918, the year following the big drop in growth rate, as shown on Plate I. This increase has continued, aside from annual fluctuations, until at the present time the losses from insects in this region are the heaviest of which we have any record. Apparently our only hope for a decline in the infestation lies in an improvement in the growing conditions that will raise the vitality of the stand to the point where it can resist the insect attacks.

CONCLUSIONS

The loss figures given show the seriousness of insect damage on cutover areas of the type studied. While we have records from no other areas covering such a long period, there are a number of areas logged more recently on which the insect loss amounts to considerably more than the growth. Site quality is apparently the most important factor determining this loss. The study of records from 23 cutover areas on the Shasta National Forest show that a high insect loss is usually found on the poorest sites and that the site III and better site IV areas suffer comparatively little insect loss.

A considerable part of the loss on the Morrison area was undoubtedly due to the poor condition of the stand after logging. Such loss can be prevented by a careful selection of the trees to be left on an area. But, the fact that the insect loss has continued for 22 years, after most of the weakest trees have been killed, and is continuing at present not only on this area but also on areas more carefully marked by the Forest Service leads to the belief that there are certain areas on which the loss from insects, during poor growing periods, will more than offset the increment regardless of how carefully the marking is done.

There are undoubtedly considerable areas now forested, on which the growing of timber will never be profitable because the margin between growth and insect loss is too small. On such areas the best policy will probably be to take out all merchantable timber when first logged, rather than leave 2 or 3 M.B.M. of merchantable timber to be killed by insects before the area can be logged again. Leaving trees which are almost certain to be killed by insects is a poor policy not only because of the waste of timber but because such trees help D. brevicomis to maintain epidemic conditions and kill more vigorous trees which under endemic conditions would survive.

Since growth rate and insect loss have been found to be very closely related it should be possible to determine the insect risk for all yellow pine areas by a study of the growth rate for a number of years back. This risk factor could then be considered in determining the management plan for any area. What evidence we have indicates that the insect loss in yellow pine is apt to be high whenever the average ring width for any number of years is less than 1 millimeter.

SUMMARY

A study of the Morrison cutover area, section 28, made in 1925 showed that for the trees over 10" D.B.H. on the area the loss in volume cuased by insects amounted to 4 times the growth. Show and Woodbury suggested that a more complete examination of the area be made to determine the total loss on the area since it was logged in 1905 and also some explanation for this loss.

This examination was made in 1927. All dead trees on the area, both standing and fallen were examined and recorded.

It was found that 1831 trees with a volume of 487,100 bd. ft. were killed in the 22 years since the area was logged. This loss amounts to over 44 per cent of the volume that was left when the area was logged.

The western pine beetle was responsible for about 70 per cent of this loss. Other insects, fire and wind account for the balance.

A study of the growth rate of trees left on the area show that:-

1. Very little acceleration of growth resulted from logging.

2. Allowing for the effect of a fire on the area between 1912 and 1917, there is some relation between growth rate and insect loss, the poorer the growth the greater the insect loss. This agrees with other studies made on this point.

   The heavy, sustained loss for the last 10 years corresponds with a slow growth period when the average ring width is less than 1 millimeter in width.

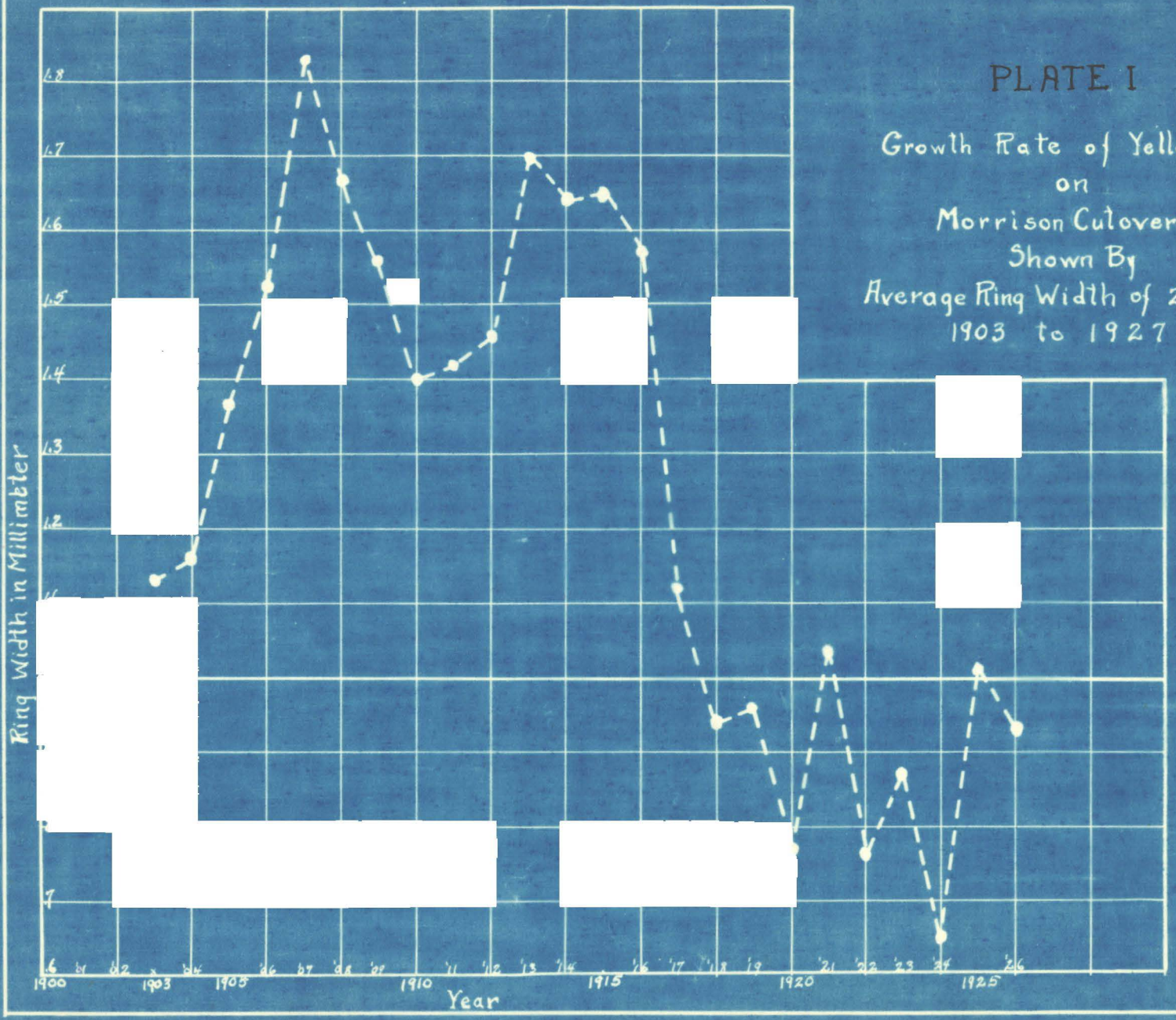
Conclusions.

There are large areas on the east side in northern California and southern Oregon where the insect loss is apt to be very heavy, especially during periods of low precipation such as we are now experiencing.

On some areas this loss will be largely eliminated by logging if sufficient care is taken in the selection of the trees to be left. But on other areas, where the average ring width of the trees left will probably fall below 1 millimeter for a number of years at some time between the first and second cuttings, the taking of all merchantable trees at the first cutting will probably prove to be the best policy.

PLATE I

Growth Rate of Yellow Pine
on
Morrison Culover Area
Shown By
Average Ring Width of 25 Trees
1903 to 1927



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